



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

SK

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/046,497	10/26/2001	Er-Xuan Ping	MTI-31041-A	8624
22202	7590	09/19/2005	EXAMINER	
WHYTE HIRSCHBOECK DUDEK S C			LE, THAO X	
555 EAST WELLS STREET			ART UNIT	
SUITE 1900			PAPER NUMBER	
MILWAUKEE, WI 53202			2814	

DATE MAILED: 09/19/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/046,497

Applicant(s)

PING ET AL.

Examiner

Thao X. Le

Art Unit

2814

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 08 August 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 101-116 and 123-224 is/are pending in the application.
- 4a) Of the above claim(s) 101-116, 123-142, 156-166, 194 and 195 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 143-155, 167-193 and 196-224 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date <u>08/08/05</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claims 143-145, 147, 149-155, 167-193, 196-202 are rejected under 35 U.S.C. 102(b) as being anticipated by US 5483094 to Sharma et al.

Regarding claims 143, 182, 186, 197, 201, Sharma discloses a semiconductor structure in fig. 10, comprising at least two overlying faceted layers of single crystal epitaxial silicon (ES), 33/34, abstract and column 3 line 42, column 8 line 5, each ES layer comprising a faceted surface, and sidewalls with insulative materials 41/61, column 4 line 64, column 5 line 29, thereover, and an uppermost faceted layer of single crystal ES 34 of the at least overlying layers of ES having a layer of an insulative material 41 over the surface, fig. 10, of said uppermost layer of ES 34, wherein the structure is situated on a substrate 10, column 3 line 18, in a vertical orientation, fig. 10.

With respect to the 'faceted surface', the pillar 31 of Sharma comprises three distinct silicon layers 32, 33 and 34. Each of these silicon layers is being growth selectively and epitaxially to create a single crystal epitaxial silicon layer 32/33/34, column 3 line 42 and column 4 line 9 and abstract. Such epitaxial silicon layer would exhibit a strong facets on its top surface as disclosed by Liaw

(4963506) in column 1 line 19-20; therefore the single crystal epitaxial silicon layers 32/33/34 would inherently having faceted surface on its top surface or the 'faceted surface' would exist between the junction of each layer 32/33/34. When the structure recited in the reference is substantially identical to that of the claims, claimed properties or functions are presumed to be inherent. Or where the claimed and prior art products are identical or substantially identical in structure or composition, or are produced by identical or substantially identical processes, a *prima facie* case of either anticipation or obviousness has been established. *In re Best*, 195 USPQ 430, 433 (CCPA 1977) and MPEP 2112.01.

Regarding to claims 144-145, 147, Sharma discloses the semiconductor structure wherein the insulative crystal 41/61 comprises an oxide, column 4 line 66, wherein the insulative crystal comprises a silicon nitride, column 5 lines 29-32.

Regarding to claims 149, 190, 196, 198, 202, Sharma discloses a semiconductor structure in fig. 12, comprising at least two overlying faceted layers 33/34 of single crystal ES, each of said layers comprising a faceted surface and sidewalls, and an insulative materials 41/61, fig. 10, over the sidewalls, an uppermost layer of the at least two overlying layers 33/34 having a layer of an insulative material 41 over the top faceted surface, one or more of the layers of ES comprising a conductivity enhancing dopant, column 3 lines 45-52, wherein the structure is situated on a substrate in a vertical orientation.

With respect to the 'faceted surface', the pillar 31 of Sharma comprises three distinct silicon layers 32, 33 and 34. Each of these silicon layers is being

growth selectively and epitaxially to create a single crystal epitaxial silicon layer 32/33/34, column 3 line 42 and column 4 line 9 and abstract. Such epitaxial silicon layer would exhibit a strong facets on its top surface as disclosed by Liaw (4963506) in column 1 line 19-20; therefore the single crystal epitaxial silicon layers 32/33/34 would inherently having faceted surface on its top surface or the 'faceted surface' would exist between the junction of each layer 32/33/34. When the structure recited in the reference is substantially identical to that of the claims, claimed properties or functions are presumed to be inherent. Or where the claimed and prior art products are identical or substantially identical in structure or composition, or are produced by identical or substantially identical processes, a *prima facie* case of either anticipation or obviousness has been established. *In re Best*, 195 USPQ 430, 433 (CCPA 1977) and MPEP 2112.01.

Regarding claims 150-153, Sharma discloses the conductivity enhancing dopant comprising a p-type dopant, which is selected from the group consisting of boron, wherein the conductivity enhancing dopant comprising a n-type dopant, which is selected from the group consisting of phosphine, column 4 lines 12-17.

Regarding claims 154-155, Sharma discloses the semiconductor structure wherein one or more of the layers of the ES comprises a concentration gradient of the dopant within the ES crystal, wherein the concentration gradient comprises a low to high concentration of the dopant within the ES, with the high dopant concentration at the top surface of the one or more of the layers, column 3 line 55-67.

Art Unit: 2814

Regarding claims 167-172, 174-175, 177, 178, 180-181, 183-185, 187-189, 191-193 Sharma discloses the semiconductor structure being a component of a transistor, being a transistor gate, being a S/D diffusion region, fig. 12, column 8 line 7, column 3 lines 46-48,

Regarding to claims 173, 176, 199, Sharma discloses a semiconductor structure in fig. 12, comprising at least two overlying faceted layers 33/34 of single crystal epitaxial silicon (ES), column 3 line 42, including an uppermost faceted layers of single crystal ES; each of said faceted layers comprising a faceted top surface and insulated sidewalls, and the uppermost faceted layer of ES having an insulated top surface; the structure is situated on a substrate in a vertical orientation, wherein the structure being a component of a transistor, fig. 10, column 8 line 7.

With respect to the 'faceted surface', the pillar 31 of Sharma comprises three distinct silicon layers 32, 33 and 34. Each of these silicon layers is being growth selectively and epitaxially to create a single crystal epitaxial silicon layer 32/33/34, column 3 line 42 and column 4 line 9 and abstract. Such epitaxial silicon layer would exhibit a strong facets on its top surface as disclosed by Liaw (4963506) in column 1 line 19-20; therefore the single crystal epitaxial silicon layers 32/33/34 would inherently having faceted surface on its top surface or the 'faceted surface' would exist between the junction of each layer 32/33/34. When the structure recited in the reference is substantially identical to that of the claims, claimed properties or functions are presumed to be inherent. Or where the claimed and prior art products are identical or substantially identical in

Art Unit: 2814

structure or composition, or are produced by identical or substantially identical processes, a *prima facie* case of either anticipation or obviousness has been established. *In re Best*, 195 USPQ 430, 433 (CCPA 1977) and MPEP 2112.01.

Regarding to claims 179, 200, Sharma discloses a semiconductor structure in fig. 12, comprising at least two overlying faceted layers of single crystal ES 33/34, each said faceted layers comprising a faceted surface, and sidewalls, and insulative materials 41/61, fig. 12, over the sidewalls, an uppermost faceted layer of ES 34 of the at least two overlying faceted layers 33/34 having a layer of an insulative material 41 over the top surface, one or more of at least two overlying faceted layers of ES comprising a conductivity enhancing dopant, column 3 lines 45-52, wherein the structure is situated on a substrate in a vertical orientation, and the structure being a component of a transistor, fig. 12 column 8 line 7.

With respect to the 'faceted surface', the pillar 31 of Sharma comprises three distinct silicon layers 32, 33 and 34. Each of these silicon layers is being growth selectively and epitaxially to create a single crystal epitaxial silicon layer 32/33/34, column 3 line 42 and column 4 line 9 and abstract. Such epitaxial silicon layer would exhibit a strong facets on its top surface as disclosed by Liaw (4963506) in column 1 line 19-20; therefore the single crystal epitaxial silicon layers 32/33/34 would inherently having faceted surface on its top surface or the 'faceted surface' would exist between the junction of each layer 32/33/34. When the structure recited in the reference is substantially identical to that of the claims, claimed properties or functions are presumed to be inherent. Or where

Art Unit: 2814

the claimed and prior art products are identical or substantially identical in structure or composition, or are produced by identical or substantially identical processes, a *prima facie* case of either anticipation or obviousness has been established. *In re Best*, 195 USPQ 430, 433 (CCPA 1977) and MPEP 2112.01.

3. Claims 203-223 rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over US 5483094 to Sharma et al.

Regarding claims 203-223, as discussed in the above claims 143, 149, 173, 176, 179, 182, 186, 190, 196, 197-202, Sharma discloses the all the claimed structure limitations in claims 203-223. Claims 203-223 are product-by-process, thus all the process limitations in claims 203-223 do not carry weight in a claim drawn to structure. *In re Thorpe*, 277 USPQ 964 (Fed. Cir. 1985).

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was

Art Unit: 2814

not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

5. Claims 146, 148 are rejected under 35 U.S.C. 103(a) as being unpatentable over US 5483094 to Sharma et al.

Regarding claims 146 and 148, Sharma does not expressly disclose the thickness of the insulative layer about 5 to 20 nm or 2 to 5 nm.

However, Sharma reference discloses an insulative layer 41/61 has a general thickness in fig. 12. Accordingly, it would have been obvious to one of ordinary skill in art to use thickness teaching Sharma in Kim device in the range as claimed, because it has been held that where the general conditions of the claims are disclosed in the prior art, it is not inventive to discover the optimum or workable range by routine experimentation. See *In re Aller*, 220 F.2d 454, 105 USPQ 233, 235 (CCPA 1955).

6. Claim 224 is rejected under 35 U.S.C. 103(a) as being unpatentable over US 5483094 to Sharma et al. in view of US 5849077 to Kenney.

Regarding claim 224, Sharma does not disclose the semiconductor structure wherein the top surface of at least one of epitaxial silicon crystal defines a face having a (100) plane orientation.

However, Kenney discloses a semiconductor structure in fig. 1m wherein the top surface of at least one of epitaxial silicon crystal 19 defines a facet having a (100) plane orientation, column 4 line 39. The silicon substrate 1 is having a

Art Unit: 2814

(100) plane orientation, column 4 line 11; thus the epitaxial layer 19 is having the same orientation. At the time the invention was made; it would have been obvious to one of ordinary skill in the art to use the (100) plane orientation 19 teaching of Kenney in Sharma's device, because the (100) plane orientation is greatly dominated the market as taught by Kenney, column 2 lines 28-30.

Response to Arguments

7. Applicant's arguments filed 08 Aug. 2005 have been fully considered but they are not persuasive because

a. The Applicant argues that Sharma does not disclose each individual layer of epitaxial silicon has a faceted surface. This is not persuasive because the pillar 31 of Sharma comprises three distinct silicon layers 32, 33, and 34. Each of the layer is being formed selectively and epitaxially, column 3 line 42. Such epitaxial silicon layer would exhibit a strong facets on its top surface as disclosed by Liaw (4963506) in column 1 line 19-20; therefore the single crystal epitaxial silicon layers 32/33/34 would inherently having faceted surface on its top surface or the 'faceted surface' would inherently exist between the junction of each layer 32/33/34. When the structure recited in the reference is substantially identical to that of the claims, claimed properties or functions are presumed to be inherent. Or where the claimed and prior art products are identical or substantially identical in structure or composition, or are produced by identical or substantially identical

processes, a *prima facie* case of either anticipation or obviousness has been established. *In re Best*, 195 USPQ 430, 433 (CCPA 1977) and MPEP 2112.01. Furthermore, the Applicant argues that the claimed 'faceted' has a plane orientation. It is well settled that, during examination proceedings, claims are given their broadest reasonable interpretation and a claim must be read in accordance with the precepts of English grammar and words should be given their plain, ordinary meaning. *In re Hyatt*, 708 F.2d 712, 218 USPQ 195 (Fed. Cir. 1983). In this case, 'faceted' would be interpreted as 'a small plane surface'; thus the plane surface between layers 32/33/34 would read on the claimed limitation. Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. *See In re Van Geuns*, 988 F. 2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

a. With respect to 'product-by-process' claims 203-223, the Examiner submits that the final structure of the product-by-process claims 203-223 would have resulted in the same structure the device's claims. Even though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process." *In re Thorpe*, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985), MPEP 2113.

Conclusion

8. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thao X. Le whose telephone number is (571) 272-1708. The examiner can normally be reached on M-F from 8:00 AM - 4:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael M. Fahmy can be reached on (571) 272 -1705. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Art Unit: 2814

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Thao X. Le
14 Sept. 2005



LONG PHAM
PRIMARY EXAMINER